MLLNVLRICI	IVCLVNDGAG	KHSEGRERTK	TYSLNSRGYF	40
RKERGARRSK	ILLVNTKGLD	EPHIGHGDFG	LVAELFDSTR	80
THTNRKEPDM	NKVKLFSTVA	HG <u>NKS</u> ARRKA	YNGSRRNIFS	120
RRSFDKRNTE	VTEKPGAKMF	WNNFLVKMNG	APQ <u>NTS</u> HGSK	160
AQEIMKEACK	TLPFTQNIVH	ENCDRMVIQN	NLCFGKCISL	200
HVPNQQDRRN	TCSHCLPSKF	TLNHLTLNCT	GSKNVVKVVM	240
MVEECTCEAH	KSNFHQTAQF	NMDTSTTLHH		270

Figure 1. Deduced amino acid sequence of Xenopus cerberus protein. SEQ ID NO:1.

Figure 2. Nucleotide sequence of the full-length cerberus DNA derived from the Xenopus organizer. The sense strand is on top (in the 5' to 3' direction) and the antisense strand on the bottom line (on the opposite direction). SEQ ID NO:2.

GAATTCCCAG	CAAGTCGCTC	AGAAACACTG	CACCCTCTAC	**********	1 momm1 om 1	
CTTAAGGGTC	GTTCAGCGAG	TOTTTOTO	CAGGGICIAG	MARACATACA	ATGTTACTAA	60
		-OIIIGIGAC	GICCCAGAIC	TATAGTATGT	TACAATGATT	
ATGTACTCAG	GATCTGTATT	ATCGTCTGCC	TTGTGAATGA	TGGAGCAGGA	A A B C B C T C B C	120
TACATGAGTC	CTAGACATAA	TAGCAGACGG	AACACTTACT	ACCTCCTCCT	TTTCTCTCACTC	120
				ACCICGICCI	TITGIGAGIC	
AAGGACGAGA	AAGGACAAAA	ACATATTCAC	TTAACAGCAG	AGGTTACTTC	AGAAAAGAAA	180
TTCCTGCTCT	TTCCTGTTTT	TGTATAAGTG	AATTGTCGTC	TCCAATGAAG	TCTTTTCTTT	100
GAGGAGCACG	TAGGAGCAAG	ATTCTGCTGG	TGAATACTAA	AGGTCTTGAT	GAACCCCACA	240
CTCCTCGTGC	ATCCTCGTTC	TAAGACGACC	ACTTATGATT	TCCAGAACTA	CTTGGGGTGT	
TTGGGCATGG	TGATTTTCGC	TTAGTAGCTG	AACTATTTGA	TTCCACCAGA	ACACATACAA	300
AACCCGTACC	ACTAAAAGCG	AATCATCGAC	TTGATAAACT	AAGGTGGTCT	TGTGTATGTT	
ACAGAAAAGA	GCCAGACATG	AACAAAGTCA	AGCTTTTCTC	AACAGTTGCC	CATGGAAACA	360
TGTCTTTTCT	CGGTCTGTAC	TTGTTTCAGT	TCGAAAAGAG	TTGTCAACGG	GTACCTTTGT	
AAAGTGCAAG	AAGAAAAGCT	TACAATGGTT	CTAGAAGGAA	TATTTTTCCT	CGCCGTTCTT	420
TTTCACGTTC	TTCTTTTCGA	ATGTTACCAA	GATCTTCCTT	ATAAAAAGGA	GCGGCAAGAA	
TTGATAAAAG	AAATACAGAG	GTTACTGAAA	AGCCTGGTGC	CAAGATGTTC	TGGAACAATT	480
AACTATTTC	TTTATGTCTC	CAATGACTTT	TCGGACCACG	GTTCTACAAG	ACCTTGTTAA	
#########						
ANNOCANEE	AATGAATGGA	GCCCCACAGA	ATACAAGCCA	TGGCAGTAAA	GCACAGGAAA	540
AAAACCAATT	TTACTTACCT	CGGGGTGTCT	TATGTTCGGT	ACCGTCATTT	CGTGTCCTTT	
TARTORAGO	»CCMMCO»»»	3.000				
ATTACTORNAGE	AGCTTGCAAA	ACCTTGTTTT	TCACTCAGAA	TATTGTACAT	GAAAACTGTG	600
ATTACTICE	TCGAACGTTT	TGGAACAAAA	AGTGAGTCTT	ATAACATGTA	CTTTTGACAC	
ACAGGATGGT	GATACAGAAC	3.3.50000000m	B80081118			
TGTCCTACCA	GATACAGAAC CTATGTCTTG	TTACACACCA	TIGGTAAATG	CATCTCTCTC	CATGTTCCAA	660
	Olmidici id	1 INGACACGA	AACCATTTAC	GTAGAGAGAG	GTACAAGGTT	
ATCAGCAAGA	TCGACGAAAT	<b>為</b> 个中でに中でくって	እ <i>ሞሞር</i> ርመመረ ር	C0000111000		
TAGTCGTTCT	AGCTGCTTTA	TGARCARGG	TARCCARCCC	GTCCAAATTT	ACCCTGAACC	720
		1 GENERAL PROPERTY	IMACGMACGG	CAGGITTAAA	TGGGACTTGG	
ACCTGACGCT	GAATTGTACT	GGATCTANGN	ATCTACTARA	CCTTCTCTTC	3.000m3.03.00	200
TGGACTGCGA	CTTAACATGA	CCTAGATTCT	TACATOATA	CCAACACTAC	MIGGIAGAGG	780
			Inchicalli	CCAACAGIAC	TACCATCTCC	
AATGCACGTG	TGAAGCTCAT	AAGAGCAACT	TCCACCAAAC	<b>TGC&amp;C&amp;GTTT</b>	A A C A TC C A TA	040
TTACGTGCAC	ACTTCGAGTA	TTCTCGTTGA	AGGTGGTTTG	ACGTGTCAAA	TTCTTCTTT	840
					TIGINCOINI	
CATCTACTAC	CCTGCACCAT	TAAAGGACTG	CCATACAGTA	TGGAAATGCC	Сттттсттсс	900
GTAGATGATG	GGACGTGGTA	ATTTCCTGAC	GGTATGTCAT	ACCTTTACGG	GAAAACAACC	900
AATATTTGTT	ACATACTATG	CATCTAAAGC	ATTATGTTGC	CTTCTATTTC	ATATAACCAC	960
TTATAAACAA	TGTATGATAC	GTAGATTTCG	TAATACAACG	GAAGATAAAG	TATATTGGTG	- • •
	•					
ATGGAATAAG	GATTGTATGA	ATTATAATTA	ACAAATGGCA	TTTTGTGTAA	CATGCAAGAT	1020
TACCTTATTC	CTAACATACT	TAATATTAAT	TGTTTACCGT	AAAACACATT	GTACGTTCTA	

CTCTGTTCCA	TCAGTTGCAA	GATAAAAGGC	AATATTTGTT	TGACTTTTTT	TCTACAAAAT	1080
GAGACAAGGT	AGTCAACGTT	CTATTTTCCG	TTATAAACAA	ACTGAAAAAA	AGATGTTTTA	
GAATACCCAA	ATATATGATA	AGATAATGGG	GTCAAAACTG	TTAAGGGGTA	ATGTAATAAT	1140
	TATATACTAT					
		•				
AGGGACTAAG	TTTGCCCAGG	AGCAGTGACC	CATAACAACC	AATCAGCAGG	TATGATTTAC	1200
TCCCTGATTC	AAACGGGTCC	TCGTCACTGG	GTATTGTTGG	TTAGTCGTCC	ATACTAAATG	
TGGTCACCTG	TTTAAAAGCA	AACATCTTAT	TGGTTGCTAT	GGGTTACTGC	TTCTGGGCAA	1260
ACCAGTGGAC	AAATTTTCGT	TTGTAGAATA	ACCAACGATA	CCCAATGACG	AAGACCCGTT	
AATGTGTGCC	TCATAGGGGG	GTTAGTGTGT	TGTGTACTGA	ATAAATTGTA	TTTATTTCAT	1320
TTACACACGG	AGTATCCCCC	CAATCACACA	ACACATGACT	TATTTAACAT	AAATAAAGTA	
TGTTACAAAA	AAAAAAA					
ACAATGTTTT	TTTTTTT					

Fig. 2. (Continuation page 2, SEQ ID NO:2).

MSR	TRKVDSL	LLLAIPGLAL	LLLPNAYCAS	CEPVRIPMCK	SMPWNMTKMP	nhlhhstqan	60
AIL	AIEQFEG	LLTTECSQDL	LFFLCAMYAP	ICTIDFQHEP	IKPCKSVCER	ARAGCEPILI	120
KYR	HTWPESL	ACEELPVYDR	GVCISPEAIV	TVEQGTDSMP	DFSMDSNNGN	CGSGREHCKC	180
KPM	KATQKTY	LKNNYNYVIR	AKVKEVKVKC	HDATAIVEVK	EILKSSLVNI	PKDTVTLYTN	240
SGC	LCPQLVA	NEEYIIMGYE	DKERTRLLLV	EGSLAEKWRD	RLAKKVKRWD	QKLRRPRKSK	300
DPV.	APIPNKN	SNSRQARS					

Figure 3. Deduced amino acid sequence of Xenopus frazzled protein. SEQ ID NO:3.

Figure 4. Nucleotide sequence of the full-length frazzled cDNA derived from the Xenopus organizer. The sense strand of the DNA on top (5' to 3' direction) and the antisense strand on the bottom line (opposite direction). SEQ ID NO:4.

GAATTCCCTT	TCACACAGGA	CTCCTGGCAG	AGGTGAATGG	TTAGCCCTAT	GGATTTGGTT	60
	AGTGTGTCCT					
TGTTGATTTT	GACACATGAT	TGATTGCTTT	CAGATAGGAT	TGAAGGACTT	GGATTTTTAT	120
ACAACTAAAA	CTGTGTACTA	ACTAACGAAA	GTCTATCCTA	ACTTCCTGAA	CCTAAAAATA	
CTAATTCTGC	ACTTTTAAAT	TATCTGAGTA	ATTGTTCATT	TTGTATTGGA	TGGGACTAAA	180
GATTAAGACG	TGAAAATTTA	ATAGACTCAT	TAACAAGTAA	AACATAACCT	ACCCTGATTT	
GATAAACTTA	ACTCCTTGCT	TTTGACTTGC	CCATAAACTA	TAAGGTGGGG	TGAGTTGTAG	240
CTATTTGAAT	TGAGGAACGA	AAACTGAACG	GGTATTTGAT	ATTCCACCCC	ACTCAACATC	
TTGCTTTTAC	ATGTGCCCAG	ATTTTCCCTG	TATTCCCTGT	ATTCCCTCTA	AAGTAAGCCT	300
AACGAAAATG	TACACGGGTC	TAAAAGGGAC	ATAAGGGACA	TAAGGGAGAT	TTCATTCGGA	
ACACATACAG	GTTGGGCAGA	ATAACAATGT	CTCGAACAAG	GAAAGTGGAC	TCATTACTGC	360
TGTGTATGTC	CAACCCGTCT	TATTGTTACA	GAGCTTGTTC	CTTTCACCTG	AGTAATGACG	
TACTGGCCAT	ACCTGGACTG	GCGCTTCTCT	TATTACCCAA	TGCTTACTGT	GCTTCGTGTG	420
ATGACCGGTA	TGGACCTGAC	CGCGAAGAGA	ATAATGGGTT	ACGAATGACA	CGAAGCACAC	
AGCCTGTGCG	GATCCCCATG	TGCAAATCTA	TGCCATGGAA	CATGACCAAG	ATGCCCAACC	480
TCGGACACGC	CTAGGGGTAC	ACGTTTAGAT	ACGGTACCTT	GTACTGGTTC	TACGGGTTGG	
ATCTCCACCA	CAGCACTCAA	GCCAATGCCA	TCCTGGCAAT	TGAACAGTTT	GAAGGTTTGC	540
TAGAGGTGGT	GTCGTGAGTT	CGGTTACGGT	AGGACCGTTA	ACTTGTCAAA	CTTCCAAACG	0.0
TGACCACTGA	ATGTAGCCAG	GACCTTTTGT	TCTTTCTGTG	TGCCATGTAT	GCCCCCATTT	600
ACTGGTGACT	TACATCGGTC	CTGGAAAACA	AGAAAGACAC	ACGGTACATA	CGGGGGTAAA	
GTACCATCGA	TTTCCAGCAT	GAACCAATTA	AGCCTTGCAA	GTCCGTGTGC	GAAAGGGCCA	660
CATGGTAGCT	AAAGGTCGTA	CTTGGTTAAT	TCGGAACGTT	CAGGCACACG	CTTTCCCGGT	000
GGGCCGGCTG	TGAGCCCATT	CTCATAAAGT	ACCGGCACAC	TTGGCCAGAG	AGCCTGGCAT	720
CCCGGCCGAC	ACTCGGGTAA	GAGTATTTCA	TGGCCGTGTG	AACCGGTCTC	TCGGACCGTA	
GTGAAGAGCT	GCCCGTATAT	GACAGAGGAG	TCTGCATCTC	CCCAGAGGCT	ATCGTCACAG	780
CACTTCTCGA	CGGGCATATA	CTGTCTCCTC	AGACGTAGAG	GGGTCTCCGA	TAGCAGTGTC	
TGGAACAAGG	AACAGATTCA	ATGCCAGACT	TCTCCATGGA	TTCAAACAAT	GGAAATTGCG	840
ACCTTGTTCC	TTGTCTAAGT	TACGGTCTGA	AGAGGTACCT	AAGTTTGTTA	CCTTTAACGC	
GAAGCGGCAG	GGAGCACTGT	AAATGCAAGC	CCATGAAGGC	AACCCAAAAG	ACGTATCTCA	900
CTTCGCCGTC	CCTCGTGACA	TTTACGTTCG	GGTACTTCCG	TTGGGTTTTC	TGCATAGAGT	- <del>- • •</del>
AGAATAATTA	CAATTATGTA	ATCAGAGCAA	AAGTGAAAGA	GGTGAAAGTG	AAATGCCACG	960
TCTTATTAAT	GTTAATACAT	TAGTCTCGTT	TTCACTTTCT	CCACTTTCAC	TTTACGGTGC	
ACGCAACAGC	AATTGTGGAA	GTAAAGGAGA	TTCTCAAGTC	TTCCCTAGTG	AACATTCCTA	1020
TGCGTTGTCG	TTAACACCTT	CATTTCCTCT	AAGAGTTCAG	AAGGGATCAC	TTGTAAGGAT	

AAGACACAGT	GACACTGTAC	ACCAACTCAG	GCTGCTTGTG	CCCCCAGCTT	GTTGCCAATG	1080
TTCTGTGTCA	CTGTGACATG	TGGTTGAGTC	CGACGAACAC	GGGGGTCGAA	CAACGGTTAC	
AGGAATACAT	AATTATGGGC	TATGAAGACA	AAGAGCGTAC	CAGGCTTCTA	CTAGTGGAAG	1140
TCCTTATGTA	TTAATACCCG	ATACTTCTGT	TTCTCGCATG	GTCCGAAGAT	GATCACCTTC	
01 maammaaa						
CTAGGAACCG	CGAAAAATGG GCTTTTTACC	AGAGATCGTC	TTGCTAAGAA	AGTCAAGCGC	TGGGATCAAA	1200
·	GCITTITACC	TOTOTAGOAG	AACGATTCTT	TCAGTTCGCG	ACCCTAGTTT	
AGCTTCGACG	TCCCAGGAAA	AGCAAAGACC	CCGTGGCTCC	AATTCCCAAC	AAAAACAGCA	1260
TCGAAGCTGC	AGGGTCCTTT	TCGTTTCTGG	GGCACCGAGG	TTAAGGGTTG	TTTTTGTCGT	
<b>み</b> がかつこれ これ これ	እርርርርርጥእርመ	#BC30#1300	C11100000			
ATTCCAGACA	AGCGCGTAGT	TAGACTAACG	GAAAGGTGTA	TGGAAACTCT	ATGGACTTTG	1320
TAAGGTCTGT	TCGCGCATCA	ATCTGATTGC	CTTTCCACAT	ACCTTTGAGA	TACCTGAAAC	
AAACTAAGAT	TTGCATTGTT	GGAAGAGCAA	AAAAGAAATT	GCACTACAGC	ACGTTATATT	1380
TTTGATTCTA	AACGTAACAA	CCTTCTCGTT	ጥጥጥርጥጥጥል ል	CGTGATGTCG	TCCAATATAA	1500
CTATTGTTTA	CTACAAGAAG	CTGGTTTAGT	TGATTGTAGT	TCTCCTTTCC	TTCTTTTTTT	1440
	GATGTTCTTC					
	ATTTGCACGT					1500
AATATTGATA	TAAACGTGCA	CAAGGGTCCG	TTAACAAAAT	AAGTTGAAGG	TCACTGTCTC	
CAGTGACTGA	ATGTCTCAGC	CTAAAGAAGC	TCAATTCATT	TCTGATCAAC	TAATGGTGAC	1560
	TACAGAGTCG					1000
<b>AA</b> GTGTTTGA	TACTTGGGGA	<b>AAGTGAACTA</b>	ATTGCAATGG	TAAATCAGAG	AAAAGTTGAC	1620
TTCACAAACT	ATGAACCCCT	TTCACTTGAT	TAACGTTACC	ATTTAGTCTC	TTTTCAACTG	
03.3.mommoom						
	TTTCCTGTAG					1680
GTTACAACGA	AAAGGACATC	TACTTGTTCA	CTCTCTAGTG	TAAATTTACT	ACTAGTGAAA	
CCATTTAATA	CTTTCAGCAG	TTTTAGTTAG	ATGACATGTA	GGATGCACCT	AAATCTAAAT	1740
GGTAAATTAT	GAAAGTCGTC	AAAATCAATC	TACTGTACAT	CCTACGTGGA	ጥጥፕልርኔጥጥፕል	1140
			oroznom	COINCGIGGR	IIIAGAIIIA	
ATTTTATCAT	AAATGAAGAG	CTGGTTTAGA	CTGTATGGTC	ACTGTTGGGA	AGGTAAATGC	1800
Taaaatagta	TTTACTTCTC	GACCAAATCT	GACATACCAG	TGACAACCCT	TCCATTTACG	
CTACTTTCTC	AATTCTGTTT	TB	CT2227222	3 mm 3 3 cmccm	333M33333	1000
CATCANACAC	THE STATE OF THE S	**************************************	CIMANTARAT	ATTAAGTCCT	AAATAAAAAA	1860
CHIGHNACHG	TTAAGACAAA	ATTTTTAACG	GATTTATTTA	TAATTCAGGA	TTTATTTTT	
AAAAAAAA	AAAAA					
TTTTTTTTT						

Fig. 4. (Continuation page 2, SEQ ID NO:4).

MLLLFRAIPM LLLGLMVLQT DCEIAQYYID EEEPPGTVIA VLSQHSIFNT TDIPATNFRL 60 120 MKQFNNSLIG VRESDGQLSI MERIDREQIC RQSLHCNLAL DVVSFSKGHF KLLNVKVEVR 180 DINDHSPHFP SEIMHVEVSE SSSVGTRIPL EIAIDEDVGS NSIQNFQISN NSHFSIDVLT RADGVKYADL VLMRELDREI QPTYIMELLA MDGGVPSLSG TAVVNIRVLD FNDNSPVFER 240 STIAVDLVED APLGYLLLEL HATDDDEGVN GEIVYGFSTL ASQEVRQLFK INSRTGSVTL 300 EGQVDFETKQ TYEFEVQAQD LGPNPLTATC KVTVHILDVN DNTPAITITP LTTVNAGVAY 360 IPETATKENF IALISTIDRA SGSNGQVRCT LYGHEHFKLQ QAYEDSYMIV TISTLDRENI 420 AAYSLTVVAE DIGFPSLKTK KYYTVKVSDE NDNAPVFSKP QYEASILENN APGSYITTVI 480 ARDSDSDQNG KVNYRLVDAK VMGQSLTTFV SLDADSGVLR AVRSLDYEKL KQLDFEIEAA 540 DNGIPQLSTR VQLNLRIVDQ NDNCPVITNP LLNNGSGEVL LPISAPQNYL VFQLKAEDSD 600 EGHNSQLFYT ILROPSRLFA INKESGEVFL KKQLNSDHSE DLSIVVAVYD LGRPSLSTNA 660 TVKFILTDSF PSNVEVVILQ PSAEEQHQID MSIIFIAVLA GGCALLLLAI FFVACTCKKK 720 AGEFKQVPEQ HGTCNEERLL STPSPQSVSS SLSQSESCQL SINTESENCS VSSNQEQHQQ 780 TGIKHSISVP SYHTSGWHLD NCAMSISGHS HMGHISTKVQ WAKEIVTSMT VTLILVENQK 840 RRALSSQCRH KPVLNTQMNQ QGSDMPITIS ATESTRVQKM GTAHCNMKRA IDCLTL

Figure 5. Deduced amino acid sequence of the Xenopus PAPC (paraxial protocadherin) protein. It encodes a member of the cadherin family of transmembrane proteins that has dorsalizing activity when constructs are injected into Xenopus embryos. SEQ ID NO:5.

Figure 6. Nucleotide sequence of the full-length PAPC cDNA derived from the Xenopus organizer. The sense strand of the DNA is shown in the top line (in the 5' to 3' direction), and the bottom line shows the antisense strand (opposite orientation). SEQ ID NO:6.

GAATTCCCAG AGATGAACTC CTTGAGATTG TTTTAAATGA CTGCAGGTCT GGAAGGATTC CTTAAGGGTC TCTACTTGAG GAACTCTAAC AAAATTTACT GACGTCCAGA CCTTCCTAAG	60
ACATTGCCAC ACTGTTTCTA GGCATGAAAA AACTGCAAGT TTCAACTTTG TTTTTGGTGC TGTAACGGTG TGACAAAGAT CCGTACTTTT TTGACGTTCA AAGTTGAAAC AAAAACCACG	120
AACTTTGATT CTTCAAGATG CTGCTTCTCT TCAGAGCCAT TCCAATGCTG CTGTTGGGAC TTGAAACTAA GAAGTTCTAC GACGAAGAGA AGTCTCGGTA AGGTTACGAC GACAACCCTG	180
TGATGGTTTT ACAAACAGAC TGTGAAATTG CCCAGTACTA CATAGATGAA GAAGAACCCC ACTACCAAAA TGTTTGTCTG ACACTTTAAC GGGTCATGAT GTATCTACTT CTTCTTGGGG .	240
CTGGCACTGT AATTGCAGTG TTGTCACAAC ACTCCATATT TAACACTACA GATATACCTG GACCGTGACA TTAACGTCAC AACAGTGTTG TGAGGTATAA ATTGTGATGT CTATATGGAC	300
CAACCAATTT CCGTCTAATG AAGCAATTTA ATAATTCCCT TATCGGAGTC CGTGAGAGTG GTTGGTTAAA GGCAGATTAC TTCGTTAAAT TATTAAGGGA ATAGCCTCAG GCACTCTCAC	360
ATGGGCAGCT GAGCATCATG GAGAGGATTG ACCGGGAGCA AATCTGCAGG CAGTCCCTTC TACCCGTCGA CTCGTAGTAC CTCTCCTAAC TGGCCCTCGT TTAGACGTCC GTCAGGGAAG	420
ACTGCAACCT GGCTTTGGAT GTGGTCAGCT TTTCCAAAGG ACACTTCAAG CTTCTGAACG TGACGTTGGA CCGAAACCTA CACCAGTCGA AAAGGTTTCC TGTGAAGTTC GAAGACTTGC	480
TGAAAGTGGA GGTGAGAGAC ATTAATGACC ATAGCCCTCA CTTTCCCAGT GAAATAATGC ACTTTCACCT CCACTCTCTG TAATTACTGG TATCGGGAGT GAAAGGGTCA CTTTATTACG	540
ATGTGGAGGT GTCTGAAAGT TCCTCTGTGG GCACCAGGAT TCCTTTAGAA ATTGCAATAG TACACCTCCA CAGACTTTCA AGGAGACACC CGTGGTCCTA AGGAAATCTT TAACGTTATC	600
ATGAAGATGT TGGGTCCAAC TCCATCCAGA ACTTTCAGAT CTCAAATAAT AGCCACTTCA TACTTCTACA ACCCAGGTTG AGGTAGGTCT TGAAAGTCTA GAGTTTATTA TCGGTGAAGT	660
GCATTGATGT GCTAACCAGA GCAGATGGGG TGAAATATGC AGATTTAGTC TTAATGAGAG CGTAACTACA CGATTGGTCT CGTCTACCCC ACTTTATACG TCTAAATCAG AATTACTCTC	720
AACTGGACAG GGAAATCCAG CCAACATACA TAATGGAGCT ACTAGCAATG GATGGGGGTG TTGACCTGTC CCTTTAGGTC GGTTGTATGT ATTACCTCGA TGATCGTTAC CTACCCCAC	780
TACCATCACT ATCTGGTACT GCAGTGGTTA ACATCCGAGT CCTGGACTTT AATGATAACA ATGGTAGTGA TAGACCATGA CGTCACCAAT TGTAGGCTCA GGACCTGAAA TTACTATTGT	840
GCCCAGTGTT TGAGAGAAGC ACCATTGCTG TGGACCTAGT AGAGGATGCT CCTCTGGGAT CGGGTCACAA ACTCTCTTCG TGGTAACGAC ACCTGGATCA TCTCCTACGA GGAGACCCTA	900
ACCTTTTGTT GGAGTTACAT GCTACTGACG ATGATGAAGG AGTGAATGGA GAAATTGTTT TGGAAAACAA CCTCAATGTA CGATGACTGC TACTACTTCC TCACTTACCT CTTTAACAAA	960
ATGGATTCAG CACTTTGGCA TCTCAAGAGG TACGTCAGCT ATTTAAAATT AACTCCAGAA TACCTAAGTC GTGAAACCGT AGAGTTCTCC ATGCAGTCGA TAAATTTTAA TTGAGGTCTT	1020

	 <del>-</del>	CAAGCAGACT GTTCGTCTGA		1080
		TACTTGTAAA ATGAACATTT		1140
		TACCCCTCTG ATGGGGAGAC		1200
 	 	GAACTTTATA CTTGAAATAT	••••	1260
		CTGTACTCTT GACATGAGAA		1320
	 	GATAGTTACC CTATCAATGG	· ·	1380
 	 	TGCAGAAGAC ACGTCTTCTG		1440
 	 	TGATGAGAAT ACTACTCTTA		1500
	 	AAATAATGCT TTTATTACGA		1560
 	 	AAATGGCAAA TTTACCGTTT		1620
		ATTTGTTTCT TAAACAAAGA		1680
	 	AAAACTTAAA TTTTGAATTT		1740
		CACTCGCGTT GTGAGCGCAA		1800
		TAATCCTCTT ATTAGGAGAA		1860
	 	CTATTTAGTT GATAAATCAA	TTCCAGCTCA AAGGTCGAGT	1920
		CTATACCATA GATATGGTAT	CTGAGAGATC GACTCTCTAG	1980
 	 	GTTCCTGAAA CAAGGACTTT	AAACAATTAA	2040
		-	GGAAGACCTT CCTTCTGGAA	2100
			TCTAACGTTG AGATTGCAAC	2160

Fig. 6. (Continuation page 2, SEQ ID NO:6).

			GATCGATATG CTAGCTATAC		2220
	- · · · - <del></del> -	 	GGCCATCTTT CCGGTAGAAA		2280
<del>-</del>		 	TGAACAACAC ACTTGTTGTG		2340
		 	CTCTTCTTCT GAGAAGAAGA		2400
		 	TTGCAGCGTG AACGTCGCAC		2460
		 	TGTACCATCT ACATGGTAGA		2520
			ACATTCTCAC TGTAAGAGTG		2580
		 	AATGACAGTG TTACTGTCAC		2640
			CAGGCACAAG GTCCGTGTTC		2700
			TATTTCAGCC ATAAAGTCGG		2760
			AAGGGCTATA TTCCCGATAT		2820
		 	ATGCCTAACC TACGGATTGG		2880
-			CCTGTTGCTA GGACAACGAT	ATCGGATGCA TAGCCTACGT	2940
				AGAGATCGTC TCTCTAGCAG	3000
				ATCCTTCAGA TAGGAAGTCT	3060
				GCAAGTGCTT CGTTCACGAA	3120
				GGGGAGACAC CCCCTCTGTG	3180
		 		ATTTTTTGTT TAAAAAACAA	3240
		 	-	CTAACTAGCA GATTGATCGT	3300

Fig. 6. (Continuation page 3, SEQ ID NO:6).

				TGAAACAGCA		3360
TAATTTAGGT	GTCTGGATGT	CAGTTTATAA	ACTCCCGGGG	ACTTTGTCGT	GIAGICAGIC	
				TGCCCTCTGT		3420
CTGGATTTCA	CCGGAAAAAT	GAAAATCGTC	GAGGACCCAG	ACGGGAGACA	CAATTAGTCG	
CCCTGGTCAA	GTCCTGAGTA	GGATCATGGC	GTTTTTATAT	GCATCTCACC	TACTTTGGAC	3480
				CGTAGAGTGG		
					> m > m > m m C m C	3540
				TCTGTGTTGT		3340
CACTAAATGT	GTATTATCCT	TTGCGAACCA	AAGTCACTTC	AGACACAACA	TATATAAGAC	
TTATATACAC	GCATTTTGTG	TTTGTGTATA	TATTTCAAGT	CCATTCAGAT	ATGTGTATAT	3600
AATATATGTG	CGTAAAACAC	AAACACATAT	ATAAAGTTCA	GGTAAGTCTA	TACACATATA	
* GTGC * G * C C	ጥጥረጥል አልጥጥል	AATATTCTGA	TACTTTTTCC	TCAATAAATA	TTTAAAT	
				AGTTATTTAT		
ICACGICIGG	NUCLITIMI	INTERNATION	AL GALLAMOU			

Fig. 6. (Continuation page 4, SEQ ID NO:6).

MVCCGPGRML LGWAGLLVLA ALCLLQVPGA QAAACEPVRI PLCKSLPWNM TKMPNHLHHS 60
TQANAILAME QFEGLLGTHC SPDLLFFLCA MYAPICTIDF QHEPIKPCKS VCERARQGCE 120
PILIKYRHSW PESLACDELP VYDRGVCISP EAIVTADGAD FPMDSSTGHC RGASSERCKC 180
KPVRATQKTY FRNNYNYVIR AKVKEVKMKC HDVTAVVEVK EILKASLVNI PRDTVNLYTT 240
SGCLCPPLTV NEEYVIMGYE DEERSRLLLV EGSIAEKWKD RLGKKVKRWD MKLRHLGLGK 300
TDASDSTQNQ KSGRNSNPRP ARS.

Figure 7. Deduced amino acid sequence of mouse FRZB-1 protein. SEQ ID NO:7.

Figure 8. Nucleotide sequence of the full-length mouse FRZB-1 cDNA. SEQ ID NO:8. AAGCCTGGGA CCATGGTCTG CTGCGGCCCG GGACGGATGC TGCTAGGATG GGCCGGGTTG 60 TTCGGACCCT GGTACCAGAC GACGCCGGGC CCTGCCTACG ACGATCCTAC CCGGCCCAAC CTAGTCCTGG CTGCTCTCTG CCTGCTCCAG GTGCCCGGAG CTCAGGCTGC AGCCTGTGAG GATCAGGACC GACGAGACC GGACGAGGTC CACGGGCCTC GAGTCCGACG TCGGACACTC CCTGTCCGCA TCCCGCTGTG CAAGTCCCTT CCCTGGAACA TGACCAAGAT GCCCAACCAC 180 GGACAGGCGT AGGGCGACAC GTTCAGGGAA GGGACCTTGT ACTGGTTCTA CGGGTTGGTG CTGCACCACA GCACCCAGGC TAACGCCATC CTGGCCATGG AACAGTTCGA AGGGCTGCTG 240 GACGTGGTGT CGTGGGTCCG ATTGCGGTAG GACCGGTACC TTGTCAAGCT TCCCGACGAC GGCACCCACT GCAGCCCGGA TCTTCTCTTC TTCCTCTGTG CAATGTACGC ACCCATTTGC 300 CCGTGGGTGA CGTCGGGCCT AGAAGAGAAG AAGGAGACAC GTTACATGCG TGGGTAAACG ACCATCGACT TCCAGCACGA GCCCATCAAG CCCTGCAAGT CTGTGTGTGA GCGCGCCCGA TGGTAGCTGA AGGTCGTGCT CGGGTAGTTC GGGACGTTCA GACACACACT CGCGCGGCCT CAGGGCTGCG AGCCCATTCT CATCAAGTAC CGCCACTCGT GGCCGGAAAG CTTGGCCTGC 420 GTCCCGACGC TCGGGTAAGA GTAGTTCATG GCGGTGAGCA CCGGCCTTTC GAACCGGACG GACGAGCTGC CGGTGTACGA CCGCGGCGTG TGCATCTCTC CTGAGGCCAT CGTCACCGCG 480 CTGCTCGACG GCCACATGCT GGCGCCGCAC ACGTAGAGAG GACTCCGGTA GCAGTGGCGC GACGGAGCGG ATTTTCCTAT GGATTCAAGT ACTGGACACT GCAGAGGGGC AAGCAGCGAA CTGCCTCGCC TAAAAGGATA CCTAAGTTCA TGACCTGTGA CGTCTCCCCG TTCGTCGCTT CGTTGCAAAT GTAAGCCTGT CAGAGCTACA CAGAAGACCT ATTTCCGGAA CAATTACAAC 600 GCAACGTTTA CATTCGGACA GTCTCGATGT GTCTTCTGGA TAAAGGCCTT GTTAATGTTG TATGTCATCC GGGCTAAAGT TAAAGAGGTA AAGATGAAAT GTCATGATGT GACCGCCGTT 660 ATACAGTAGG CCCGATTTCA ATTTCTCCAT TTCTACTTTA CAGTACTACA CTGGCGGCAA GTGGAAGTGA AGGAAATTCT AAAGGCATCA CTGGTAAACA TTCCAAGGGA CACCGTCAAT 720 CACCTTCACT TCCTTTAAGA TTTCCGTAGT GACCATTTGT AAGGTTCCCT GTGGCAGTTA CTTTATACCA CCTCTGGCTG CCTCTGTCCT CCACTTACTG TCAATGAGGA ATATGTCATC 780 GAAATATGGT GGAGACCGAC GGAGACAGGA GGTGAATGAC AGTTACTCCT TATACAGTAG ATGGGCTATG AAGACGAGGA ACGTTCCAGG TTACTCTTGG TAGAAGGCTC TATAGCTGAG 840 TACCCGATAC TTCTGCTCCT TGCAAGGTCC AATGAGAACC ATCTTCCGAG ATATCGACTC AAGTGGAAGG ATCGGCTTGG TAAGAAAGTC AAGCGCTGGG ATATGAAACT CCGACACCTT 900 TTCACCTTCC TAGCCGAACC ATTCTTTCAG TTCGCGACCC TATACTTTGA GGCTGTGGAA GGACTGGGTA AAACTGATGC TAGCGATTCC ACTCAGAATC AGAAGTCTGG CAGGAACTCT 960

CCTGACCCAT TTTGACTACG ATCGCTAAGG TGAGTCTTAG TCTTCAGACC GTCCTTGAGA

				0000303000	A COCCA CINCOCC	1020
		CTAAATCCTG				1020
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		GACTAACAAA				1000
AAGATTCTGA	CCGCGACCAC	CTGATTGTTT	CC1-1-1-1-GGCG	TGTCAACACG	AGCACIGGCI	
		GTGGCTACCG	3.3. COMM3. COMMC	CCCTCCCCTT	ጥርጥርርጥር	1140
TTGTTTACCG	CAGACACCGC	CACCGATGGC	MMC3 AMC3 AC	CCCACCCCA	ACACCACCAA	1140
AACAAATGGC	GTCTGTGGCG	CACCGATGGC	TTCAATGAAG	GCCAGGGGAA	AGAGGACGAA	
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CTTAATGGCG	1GGGGTTAGA	AGGAAATTAT	TGTIVIVIVI	ACACAAAGTA	GTTAGTGCAC	
GAATTACCGC	ACCCCAATCT	AGGAAATTAT	ACARITATA	110110111110111		
CCC3 CTCTTC	መመመመርር እ እ ር ር	AGAATAGTAA	ATTAAATATG	TTGATGCTAA	GGTTTCTGTA	1260
CCCCCACAAC	A A A COTTO	TCTTATCATT	таатттатас	AACTACGATT	CCAAAGACAT	
CCCIGACAAG	AAAACGIIGG	icimicmi				
CTCC & CTCCC	ጥርርርጥጥጥልልጥ	TTGGTGTTCT	GTACCCTGAT	TGAGAATGCA	ATGTTTCATG	1320
CIGGACICC	ACCCAAATTA	AACCACAAGA	CATGGGACTA	ACTCTTACGT	TACAAAGTAC	
GACCIGAGGG	ACCOMPANIA.	12.00				
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ATTTCTCTCT	TAGGACCAGT	ATAGAGTTCT	TGATCTATAA	CGACATTCTG	TCGGAGACGA	
GCTGCGCTTA	TAGTCTTGTG	TTTGTATGCC	TTTGTCCATT	TCCCTCATGC	TGTGAAAGTT	1440
CGACGCGAAT	ATCAGAACAC	AAACATACGG	AAACAGGTAA	AGGGAGTACG	ACACTTTCAA	
ATACATGTTT	ATAAAGGTAG	AACGGCATTT	TGAAATCAGA	. CACTGCACAA	GCAGAGTAGC	1500
TATGTACAAA	TATTTCCATC	TTGCCGTAAA	ACTTTAGTCT	GTGACGTGTI	CGTCTCATCG	
CCAACACCAG	GAAGCATTTA	TGAGGAAACG	CCACACAGCA	TGACTTATTI	TCAAGATTGG	1560
GGTTGTGGTC	CTTCGTAAAI	ACTCCTTTGC	GGTGTGTCGT	ACTGAATAAA	AGTTCTAACC	
						4.500
CAGGCAGCAA	AATAAATAGI	GTTGGGAGCC	AAGAAAAGAA	A TATTTTGCCT	GGTTAAGGGG	1620
GTCCGTCGTI	TTATTTATCA	A CAACCCTCGG	TTCTTTTCTT	r ATAAAACGGA	CCAATTCCCC	
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CACACTGGAA	A TCAGTAGCCC	TTGAGCCATT	AACAGCAGTC	3 TICTICIGG	AAGTTTTTGA	1000
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			GGAAAAGAAA CCTTTTCTTT			1860
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GTGCACCAGG	GTGTTATTTA	ACAGAGGTAT	GTAACTCTAT	AAAAGACTAT	AATTTACAGG	1920
CACGTGGTCC	CACAATAAAT	TGTCTCCATA	CATTGAGATA	TTTTCTGATA	TTAAATGTCC	
>C>CCC>>>M	CMCCA CA MMM		TTTCTTCCTT	ኯጥረርጥጥጥርርር	Сттстсатт	1980
			AAAGAAGGAA			
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TGGTTTTTGG	TGTGTTTATG	TCTGTATTTT	GGGGGGTGGG	TAGGTTTAAG	CCATTGCACA	2040
ACCAAAAACC	ACACAAATAC	AGACATAAAA	CCCCCACCC	ATCCAAATTC	GGTAACGTGT	
						2100
			GCTCATTGGC			2100
AAGTTCAACT	TGATCTAATC	TCATCTGATC	CGAGTAACCG	GATCTGTAAT	ACTAAACTTA	
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AACACAACAA	ATTACGAGGT	AGTTCTACAG	ATTATTTTCC	TIMIACCAAC	AGIIGICICI	
CGACAACAAC	AACAAA					
GCTGTTGTTG	TTGTTT					

MVCGSPGGML	LLRAGLLALA	ALCLLRVPGA	RAAACEPVRI	PLCKSLPWNM	TKMPNHLHHS	60
TQANAILAIE	QFEGLLGTHC	SPDLLFFLCA	MYAPICTIDF	QHEPIKPCKS	VCERARQGCE	120
PILIKYRHSW	PENLACEELP	VYDRGVCISP	EAIVTADGAD	FPMDSSNGNC	RGASSERCKC	180
KPIRATQKTY	FRNNYNYVIR	AKVKEIKTKC	HDVTAVVEVK	EILKSSLVNI	PRDTVNLYTS	240
SGCLCPPLNV	NEEYIIMGYE	DEERSRLLLV	EGSIAEKWKD	RLGKKVKRWD	MKLRHLGLSK	300
SDSSNSDSTQ	SQKSGRNSNP	RQARN.				

Figure 9. Deduced amino acid sequence of human FRZB-1 protein. SEQ ID NO:9.

Figure 10. Nucleotide sequence of the full-length human FRZB-1 cDNA. SEQ ID NO:10. This sequence was assembled from public ESTs from the Genbank database (accession numbers: H18848, R63748, W38677, W44760, H38379 and N71244).

GGCGGAGCGG	GCCTTTTGGC (	GTCCACTGCG (	CGGCTGCACC	CTGCCCCATC	TGCCGGGATC	60
CCGCCTCGCC	CGGAAAACCG	CAGGTGACGC (	GCCGACGTGG	GACGGGGTAG	ACGGCCCTAG	
				eccecomoom	macacamacam	120
ATGGTCTGCG	GCAGCCCGGG .	AGGGATGCTG	CIGCIGCGG	CCGGGCTGCT	1600016601	120
TACCAGACGC	CGTCGGGCCC	TCCCTACGAC	GACGACGCCC	GGCCCGACGA	ACGGGACCGA	
GCTCTCTGCC	TGCTCCGGGT	GCCCGGGGCT	CGGGCTGCAG	CCTGTGAGCC	CGTCCGCATC	180
CGAGAGACGG	ACGAGGCCCA	CGGGCCCCGA	GCCCGACGTC	GGACACTCGG	GCAGGCGTAG	
CCCCTGTGCA	AGTCCCTGCC	CTGGAACATG	ACTAAGATGC	CCAACCACCT	GCACCACAGC	240
GGGGACACGT	TCAGGGACGG	GACCTTGTAC	TGATTCTACG	GGTTGGTGGA	CGTGGTGTCG	
						200
ACTCAGGCCA	ACGCCATCCT	GGCCATCGAG	CAGTTCGAAG	GTCTGCTGGG	CACCCACTGC	300
TGAGTCCGGT	TGCGGTAGGA	CCGGTAGCTC	GTCAAGCTTC	CAGACGACCC	GTGGGTGACG	
	TGCTCTTCTT	00000000000	A MCMA CCCCC	CCATCTCCAC	<u> </u>	360
AGCCCCGATC	TGCTCTTCTT	CCTCTGTGCC	MA CAMOCOCCC	CCMICIGCAC	CTAACTCAAC	
TCGGGGCTAG	ACGAGAAGAA	GGAGACACGG	TACATGCGCG	GGIAGACGIG	GIANCIGANO	
CAGCACGAGC	CCATCAAGCC	СТСТААСТСТ	GTGTGCGAGC	GGGCCCGGCA	GGGCTGTGAG	420
CRCCRCCTCC	GGTAGTTCGG	GACATTCAGA	CACACGCTCG	CCCGGGCCGT	CCCGACACTC	
0100100100	00111011000					
CCCATACTCA	TCAAGTACCG	CCACTCGTGG	CCGGAGAACC	TGGCCTGCGA	GGAGCTGCCA	480
GGGTATGAGT	AGTTCATGGC	GGTGAGCACC	GGCCTCTTGG	ACCGGACGCT	CCTCGACGGT	
						<b>540</b>
GTGTACGACA	GGGGCGTGTG	CATCTCTCCC	GAGGCCATCG	TTACTGCGGA	CGGAGCTGAT	540
CACATGCTGT	CCCCGCACAC	GTAGAGAGGG	CTCCGGTAGC	AATGACGCCT	GCCTCGACTA	
					COCORD N NOCO	600
TTTCCTATGG	ATTCTAGTAA	CGGAAACTGT	AGAGGGGCAA	GCAGTGAACG	CIGIAAAIGI	800
AAAGGATACC	TAAGATCATT	GCCTTTGACA	TCTCCCCGTT	CGTCACTIGC	GACATTTACA	
3.3.C.C.C.M.3.M.M.3.	GAGCTACACA	CAACACCTAT	TTCCGGAACA	ATTACAACTA	TGTCATTCGG	660
MUCCONTIN	CMCCAMCMCM	CHALCHCCAUP	A A CGC CTTGT	TAATGTTGAT	ACAGTAAGCC	
TICGGATAAT	CICGAIGIGI	CIICIGGAIA	HICCCCI I C			
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CCAMMACAAT	ጥጥርጥርጥልጥጥ	CTGATTCACG	GTACTACACT	GACGTCATCA	CCTCCACTTC	
GAGATTCTAA	AGTCCTCTCT	GGTAAACATI	CCACGGGAC	CTGTCAACCT	CTATACCAGC	780
CTCTAAGATT	TCAGGAGAGA	CCATTTGTAA	GGTGCCCTGT	r gacagttgg/	A GATATGGTCG	
						0.40
TCTGGCTGCC	TCTGCCCTCC	ACTTAATGTT	AATGAGGAA'	r atatcatca:	r GGGCTATGAA	840
AGACCGACGC	AGACGGGAGG	G TGAATTACAA	TTACTCCTT	A TATAGTAGT	A CCCGATACTT	

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GATGAGGAAC	GTTCCAGATT	ACTCTTGGTG	GAAGGCTCTA	TAGCTGAGAA	GTGGAAGGAT	900
CTACTCCTTG	CAAGGTCTAA	TGAGAACCAC	CTTCCGAGAT	ATCGACTCTT	CACCTTCCTA	
CGACTCGGTA	AAAAAGTTAA	GCGCTGGGAT	ATGAAGCTTC	GTCATCTTGG	ACTCAGTAAA	960
	TTTTTCAATT					
AGTGATTCTA	GCAATAGTGA	TTCCACTCAG	AGTCAGAAGT	CTGGCAGGAA	CTCGAACCCC	1020
	CGTTATCACT					
CGGCAAGCAC	GCAACTAAAT	CCCGAAATAC	AAAAAGTAAC	ACAGTGGACT	TCCTATTAAG	1080
	CGTTGATTTA					
ACTTACTTGC	ATTGCTGGAC	TAGCAAAGGA	AAATTGCACT	ATTGCACATC	ATATTCTATT	1140
	TAACGACCTG					
GTTTACTATA	AAAATCATGT	GATAACTGAT	TATTACTTCT	GTTTCTCTTT	TGGTTTCTGC	1200
	TTTTAGTACA					
TTCTCTCTTC	TCTCAACCCC	TTTGTAATGG	TTTGGGGGCA	GACTCTTAAG	TATATTGTGA	1260
	AGAGTTGGGG					
GTTTTCTATT	TCACTAATCA	TGAGAAAAAC	TGTTCTTTTG	CAATAATAAT	AAATTAAACA	1320
	AGTGATTAGT					
TGCTGTTACC	AGAGCCTCTT	TGCTGAGTCT	CCAGATGTTA	ATTTACTTTC	TGCACCCCAA	1380
	TCTCGGAGAA					
TTGGGAATGC	AATATTGGAT	GAAAAGAGAG	GTTTCTGGTA	TTCACAGAAA	GCTAGATATG	1440
	ТТАТААССТА					
CCTTAAAACA	TACTCTGCCG	ATCTAATTAC	AGCCTTATTT	TTGTATGCCT	TTTGGGCATT	1500
	ATGAGACGGC					
CTCCTCATGC	TTAGAAAGTT	CCAAATGTTT	ATAAAGGTAA	AATGGCAGTT	TGAAGTCAAA	1560
	AATCTTTCAA					
	GCAAAGCAAT					1620
	CGTTTCGTTA					
					AGAACATTTT	1680
	AACTCTGACA					
					TAGCATTCTT	1740
	CTTCGTGTTG					
					GAAATGAATT	1800
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					TTTAAATAAA	1860
	TAGACGACAA AAAGTCAAAA			AAACGAAGGA	TTTATTTAAA	
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